

RELATIONSHIP BETWEEN HbA1c AND SYSTOLIC AND DIASTOLIC BLOOD PRESSURE IN PATIENTS WITH TYPE 2 DIABETES MELLITUS AT PKU MUHAMMADIYAH GUBUG HOSPITAL

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ABSTRAK

Background: Type 2 diabetes mellitus is a chronic metabolic disease accompanied by complications such as hypertension. HbA1c is used to assess long-term blood sugar control, which can affect blood pressure. From medical record data for June-July 2024, there were 55 patients with type 2 diabetes mellitus at PKU Muhammadiyah Gubug Hospital. **Objective:** The relationship between HbA1c and systolic and diastolic blood pressure in patients with type 2 diabetes mellitus at PKU Muhammadiyah Gubug Hospital. **Methods:** The study used an analytical observational design with a cross-sectional approach. Data is obtained from the patient's medical records. Samples were selected using the purposive sampling method, and the analysis was carried out by the Chi-Square test. **Results:** Of the 55 respondents, 17 were male (30.9%) and 38 female (69.1%). 25-44 years old as many as 2 people (3.6%), 45-64 years old 33 people (60.0%), and >65 years old 20 people (36.4%). The duration of treatment was 1-5 days for 53 people (96.4%) and 6-10 days for 2 people (3.6%). Systolic blood pressure ≤ 140 mmHg in 18 people (32.7%) and > 140 mmHg in 37 people (67.3%). Diastolic blood pressure ≤ 90 mmHg in 29 people (52.7%) and > 90 mmHg in 26 people (47.3%). HbA1c was good ($< 6.5\%$), 6 people (10.9%), moderate (6.5-8%), 14 people (25.5%), and poor ($> 8\%$) 35 people (63.6%). The Chi-Square test showed a p-value for HbA1c with systolic blood pressure of 0.014 and diastolic 0.039 (both < 0.05). **Conclusion:** There is a relationship between HbA1c and systolic and diastolic blood pressure in type 2 diabetes mellitus patients at PKU Muhammadiyah Gubug Hospital.

Keywords : Type 2 diabetes mellitus, HbA1c, systolic blood pressure, diastolic blood pressure.

INTRODUCTION

Diabetes mellitus (DM) is a group of metabolic diseases characterized by hyperglycemia due to abnormalities in insulin secretion, insulin action and both. The risk of diabetes complications can be controlled and reduced by controlling blood sugar levels. The calculation of glycated hemoglobin (HbA1c) is described as a blood sugar index within 1-3 months, because 120 days is the age at which erythrocytes become HbA1c is a core parameter of diabetes control. One of the efforts to avoid these complications is to control blood sugar by checking HbA1c levels. The HbA1c test is a test that plays a role in calculating the average amount of hemoglobin HbA1c bound to glucose over the past 3 months.² Diabetes is grouped into 4 types of diabetes: type 1 diabetes, type 2 diabetes, gastrointestinal diabetes, and diabetes for other causes.¹

Diabetes was associated with risk aspects that could not be renewed, including a diabetic family background (first-degree relative), age ≥ 45 years, ethnicity, and a previous birth weight > 4000 grams as well as a background of previous gestational diabetes and low birth weight (< 2.5 kg). Risk factors that can be changed include obesity based on a BMI ≥ 25 kg/m² and a waist circumference of ≥ 80 cm for women and ≥ 90 cm for men, lack of physical activity, hypertension, dyslipidemia and an unhealthy diet.³

Diabetes is one of the various degenerative diseases that are increasing every year in a number of countries in the world. It is a chronic disease characterized by a physical inability to produce insulin or use insulin efficiently.

Hypertension is one of the most common factors for loss of life worldwide. *The World Health Organization* (WHO) predicts that the global prevalence of hypertension is around 22%

of the world's population. According to some of the sufferers, under one in five people try to control their blood pressure.

Diabetics really need to control blood sugar, control blood glucose and diabetics can pay attention to 2 aspects, the first is momentary blood sugar and the second is long-term blood sugar. Momentary blood glucose monitoring can be checked with GD2PP, while in long blood glucose can be carried out by a more specific check, namely the HbA1c test.¹

High blood pressure is not understood until doctors do routine blood pressure checks or health checks for work reasons. People with high blood pressure are 3x more likely to have a heart attack and 5x more likely to experience unsuccessful cardiac activity. 8x more likely to have a stroke than people with stable blood pressure.⁵

Given the high number of hypertension and diabetes cases in Indonesia, driven by the control of HbA1c and the increase in HbA1c which is a trigger for hypertension and causes an increase in systolic and diastolic blood pressure for diabetics, researchers want to find out the relationship between HbA1c and systolic and diastolic blood pressure in patients with Type 2 Diabetes Mellitus at PKU Muhammadiyah Gubug Hospital.

RESEARCH METHODS

This study uses an analytical observational design with a cross-latitude approach. The target population in this study is diabetic mellitus patients at PKU Muhammadiyah Gubug Hospital. The population targeted in this study includes all patients with diabetes mellitus who undergo inpatient and outpatient treatment at PKU Muhammadiyah Gubug Hospital. This study uses a *non-probability sampling* method with a *purposive sampling* approach as a sampling technique.

RESULT

This study was carried out at PKU Muhammadiyah Gubug Hospital as many as 55 respondents with diabetes mellitus diagnosis as a sample in this study, which was selected using the purposive sampling method. The research data was obtained from the patient's medical records, including information about gender, age, length of treatment, blood pressure, and HbA1c levels of type 2 DM patients at PKU Muhammadiyah Gubug Hospital.

Table 1 Systolic Blood Pressure			
Characteristic	Group Variation	Number of Patients	Presentation (%)
Blood Pressure Systolic	≤ 140 mmHg	18	32,7
	>140 mmHg	37	67,3
	Total	55	100

This study analyzed diastolic blood pressure from 55 respondents. The results showed that most of the respondents, namely 37 people (67.3%), had systolic blood pressure of >140 mmHg. Meanwhile, as many as 18 people (32.7%) had systolic blood pressure ≤ 140 mmHg.

Table 2 Diastolic Blood Pressure			
Characteristic	Group Variation	Number of Patients	Presentation (%)
Blood Pressure Diastolic	≤ 90 mmHg	29	52,7
	>90 mmHg	26	47,3
	Total	55	100

This study analyzed diastolic blood pressure from 55 respondents. The results showed that most of the respondents, namely 29 people (52.7%), had diastolic blood pressure ≤ 90 mmHg. Meanwhile, as many as 26 people (47.3%) had diastolic blood pressure >90 mmHg.

Tabel 3 HbA1C			
Characteristic	Group Variation	Number of Patients	Presentation (%)
Blood Pressure Diastolic	≤ 90 mmHg	29	52,7
	>90 mmHg	26	47,3

Total		55	100
Characteristic	Group Variation	Number of Patients	Presentation (%)
HbA1C levels	good (<6%)	6	10,9
	medium (<6,5-8%)	14	25,5
	bad (>8%)	35	63,6
	Total	55	100

This study analyzed HbA1C levels from 55 respondents to assess blood sugar control. The results showed that some of the respondents, as many as 35 people (63.6%), had HbA1C levels that were included in the moderate category (6.5-8%), while only 6 people (10.9%) had good HbA1C levels (<6.5%). The results of the analysis showed a significance value of 0.317 ($p > 0.05$), which showed that the data had a normal distribution. With this assumption fulfilled, the Chi-Square test can be used precisely to analyze the relationship between HbA1c levels and systolic and diastolic blood pressure.

Table 4 The Relationship between HbA1C and Systolic Blood Pressure

HbA1C Levels	Systolic blood pressure				n	%	p-value
	≤140		>140				
	mmHg		mmHg				
	n	%	n	%			
Good (<6%)	5	9,1	1	1,8	6	10,9	0,014
Medium (6,5-8%)	5	9,1	9	16,4	14	25,5	
Bad (>8%)	8	14,5	27	49,1	35	63,6	
Total	18	32,7	37	67,3	55	100	

The relationship between HbA1C and systolic blood pressure in 55 respondents showed a diverse distribution in each group. A total of 6 people (10.9%) had good HbA1C levels (<6%), with 5 people (9.1%) in the systolic blood pressure category ≤ 140 mmHg and 1 person (1.8%) in the systolic blood pressure category >140 mmHg. In the category of moderate HbA1C levels (6.5-8%), there were 14 respondents (25.5%), with 5 people (9.1%) having systolic blood pressure ≤ 140 mmHg and 9 people (16.4%) having systolic blood pressure >140 mmHg. The majority of respondents, namely 35 people (63.6%), had poor HbA1C levels (>8%), with 8 people (14.5%) in the systolic blood pressure category ≤ 140 mmHg and 27 people (49.1%) in the systolic blood pressure category >140 mmHg.

The Chi Square *test* showed a p-value of 0.039, which is smaller than the significance limit of 0.05. This shows that there is a significant relationship between HbA1C levels and diastolic blood pressure in respondents in patients with type 2 diabetes mellitus at PKU Muhammadiyah Gubug Hospital.

DISCUSSION

Most of the respondents in this study were women, indicating that diabetes mellitus is more experienced by women than men because they have higher amounts of triglycerides, which are the bad cholesterol that causes the disease. Insulin resistance in menopausal women is caused by decreased estrogen levels, which in turn increases the strengthening of body fat and increases free fatty acid reserves, causing a high rate of diabetes cases in women.⁶

This age group is an advanced age transition period, where organ function decreases, making it more susceptible to various chronic diseases.⁴ These findings indicate the need for a more intensive preventive and promotive approach, especially at the age of 45-64 years, to prevent the development of chronic diseases that can continue into old age. The importance of structured care management and the availability of adequate diagnostic facilities, so that care can be tailored to the patient's needs without extending the duration of the hospital stay unnecessarily.⁷

The results revealed that most of the patients, as many as 37 people (67.3%) had systolic blood pressure above 140 mmHg which indicated hypertension. Meanwhile, patients with systolic blood pressure ≤ 140 mmHg totaled 18 people (32.7%). The total number of patients observed was 55 people. These data show a high prevalence of hypertension in the population studied, highlighting the importance of blood pressure management as part of a cardiovascular complication prevention strategy.

The results of this study seek the prevention and management of hypertension, especially for groups with systolic blood pressure >140 mmHg. Suggested strategies include educating the public about a healthy lifestyle, routine blood pressure checks, and appropriate treatment to reduce the risk of long-term complications due to hypertension.

Most of the patients had diastolic blood pressure ≤ 90 mmHg, as many as 29 people (52.7%). Meanwhile, 26 people (47.3%) were recorded to have diastolic blood pressure >90 mmHg, which is included in the category of diastolic hypertension. The total number of patients is 55 people. These findings indicate that high diastolic blood pressure is still a concern, even though most patients are in the normal category or close to the prehypertensive limit. The group of patients with diastolic blood pressure ≤ 90 mmHg (52.7%) represents a population with better blood pressure control or those who have not yet developed diastolic hypertension. Patients with normal blood pressure are more likely to lead a healthy lifestyle, including maintaining an ideal body, reducing salt intake, and exercising regularly.⁸

The distribution of HbA1C levels of patients was 6 patients (10.9%) had good HbA1C levels ($<6.5\%$), 14 patients (25.5%) had moderate HbA1C levels (6.5-8%), and the majority of patients, namely 35 people (63.6%) had poor HbA1C levels ($>8\%$). The total number of patients is 55 people. These findings suggest that most patients have suboptimal glycemic control, which can increase the risk of long-term diabetes complications such as neuropathy, nephropathy, and retinopathy. These findings emphasize the importance of effective strategies to control HbA1C levels, especially in groups with poor HbA1C levels ($>8\%$). As well as efforts such as education, periodic monitoring, and an individualized approach to therapy can help prevent long-term complications.

There was a significant relationship between HbA1C and systolic blood pressure in patients with type 2 diabetes mellitus at PKU Muhammadiyah Gubug Hospital. This is indicated by a p value of 0.014 ($p < 0.05$). So patients with worse HbA1C levels tend to have greater systolic blood pressure. the importance of optimal management of HbA1C levels to reduce the risk of hypertension in diabetic patients. And suggested efforts include providing continuous education about low-glycemic diets, strict supervision of therapy compliance, and routine monitoring of blood pressure and HbA1C levels.

There was a significant relationship between HbA1C and diastolic blood pressure in type 2 diabetes mellitus patients at PKU Muhammadiyah Gubug Hospital. This is indicated by a p value of 0.039 ($p < 0.05$). High HbA1C levels are usually associated with poor blood pressure control, including diastolic blood pressure. However, some studies suggest that high levels of HbA1C can be found in individuals with normal diastolic blood pressure. This can occur due to other factors such as insulin resistance, obesity, or an unhealthy lifestyle, which affect glucose metabolism without causing significant changes in diastolic blood pressure.

CONCLUSION

Based on the research that has been conducted, the results are obtained that there is a relationship between HbA1C and systolic and diastolic blood pressure in patients with type 2 diabetes mellitus at PKU Muhammadiyah Gubug Hospital.

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